BENDKING PIPE BENDING MACHI\NE DEMONSTRATION

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Disclaimer

Abstract

BendKing, Inc. came to Wyoming in December 2001 to demonstrate their horizontal pipe bending machine, capable of bending pipe on-site to facilitate pipeline installation, to the American market. The demonstration was held at the Rocky Mountain Oilfield Testing Center (RMOTC), 40 miles north of Casper, Wyoming, in the Teapot Dome oil field. The demonstration pipe used was bare 6-inch, Sch 80, 432WT – X42 pipe with a .432-inch wall thickness capable of withstanding 4,110 psi burst pressure, and is associated with RMOTC's high-pressure flow loop. BendKing's device was able to bend the pipe in S-curves on-site, with each S-bend taking ½ hr. even with an inexperienced crew running the machine; joints were found to be almost identical when placed side by side.

Background

Pipe is traditionally bent vertically "on the fly" with a sideboom equipped with cables and a bending "shoe". These types of bends are usually made to follow the elevation differences in terrain so the pipe will follow the bottom of the ditch and maintain a constant depth (referenced to the ground level). When the pipe is routed, any change in bearing has to be done gradually to allow the line to be pigged. This is typically not a problem unless the space is limited. Space limitations come into play at the termination ends of the pipeline (e.g. when the pipe comes into a production facility or plant). Usually, the pipe is sent to an expensive pipe "hot" bending facility where the bends are pre-fabricated. The bent pipe is installed and the pipeline is tied into the inlet of the pre-fabricated pipe.

A common problem associated with bending pipe is wrinkling on the inner side of the bend. This problem is especially prevalent in large diameter, thin walled pipe. The thicker walled pipe is more resistant to this type of problem. Another problem with bending pipe is that the outer is subjected to "stretch" which means it's wall is thinned to cover the greater distance the pipe must travel in the bend. Standard degrees a pipe can be bent per unit length are well established and published in ASME code books.

Pigging a pipeline is a process in which a composite plug is inserted into one end of the pipe with pressure being applied behind the pig, forcing it to traverse the length of the pipe. The pig wipes the inside of the pipe, pushing slag and other foreign material (e.g. dirt, rock pebbles, etc.) ahead. When the pig comes out the other end of the pipe this foreign material is pushed out. The pig can get stuck in the pipe if the bends are too short, which results in having to locate the pig and mechanically remove it. Once the pig is removed in this manner, the pipeline has to be modified so the pig can move freely down the pipe.

BendKing's Horizontal Pipe Bending Machine

The skid-mounted version of the machine consists of a 13 hp, gasoline motor that powers a hydraulic system to move hydraulic rams that bend the pipe. The rams have been outfitted with a pivoting head that would hold the pipe securely during the bending operation. The pivoting head is changed out for each size of pipe to be bent, eliminating the chance of the pipe slipping or taking on an oblong shape during the bend. A limit switch on the machine stops the machine at the desired amount of bend for each stroke. A cable, attached to a hook, is inserted into the tail end of the pipe to position the pipe for the next stroke of the bend. The controls for both of the systems are conveniently located next to each other, allowing the operator to control the process from a central point. The machine features a safety design that does not allow the operator to get a hand, or any other body part near any pinch areas. The pivoting head also acts like a clamp, preventing the pipe from slipping and allows the operator to be in complete control during the bending process. This demonstration took place on a single location, but the machine is designed to be towed behind a piece of equipment, making it portable.

The Demonstration

The 7ft wide x 14ft long, pipe bender was transported to the site on a flatbed trailer. The machine was leveled using wood timbers, and six joints of pipe were stockpiled next to the machine. A crane truck was brought in and placed the pipe in the machine. The first joint was inserted into the machine and RMOTC personnel were instructed in the operation of the pipe bender. The pipe was bent to the desired 45 degree angle, rotated 180 degrees in the machine and bent into the desired S-curve configuration. After each bend was completed, two string lines and a protractor were used to check the degrees of each bend. After the bends were checked, the pipe was removed from the machine and the next joint was inserted into the machine. The first S-bend took about an hour to perform. Subsequent bends took 30 to 35 minutes to complete. The last pipe to be bent consisted of a 90 degree bend, which took 20 minutes to complete.

Results of the Demonstration

Overall the machine preformed very well. The 13 hp gasoline motor provided more than enough power to bend the schedule 80 pipe. The personnel running the machine were able to turn out consistent bends with minimal training in a short amount of time. The machine bends the pipe by creating a predetermined amount of bend per stroke. The pipe is then moved one diameter length and the process is repeated until the total amount of bend is achieved. For example, a 6-inch diameter pipe bent at a 45 degree angle can be obtained with eleven strokes set at 4 ± 1 degree per stroke. The overall length of pipe

needed for the bend would be 66 inches. No wrinkling effect was observed externally; however, the bends were not checked to quantify the amount of thinning of the pipe. The machine was able to run for 10 hours on 2 gallons of gasoline.

Conclusions

The machine can be run by one operator, but a second hand to help handle the pipe is recommended. It is also recommended that the angle be checked before and after performing the last bend to assure that it is correct. Keeping the ends of the pipe at the same level throughout the bending process is essential to keep "spiraling" effects to a minimum. The replication of identical parts was achieved in a short amount of time, eliminating the need for the pipe to be shipped off for "hot" bending work. The pivoting head acted like a vice, eliminating pipe slippage, and providing for safer operation. The machine is self-contained but extra gasoline cans for refueling would be needed for longer jobs. BendKing is currently developing a large diameter version of this machine (for pipe 12 inch and greater).